

Transport pathways, distribution, and flux of metals in Ganga Estuary (Hooghly): Implication on the geochemical mass budget of seawater

PRATYUSHA CHANDA¹, SAMRIDHI JAIN² AND DR. SAMBUDDHA MISRA³

¹Indian Institute of Science

²Banasthali University

³Indian Institute of Sciences

Presenting Author: sambuddha@iisc.ac.in

Accurate quantification of the flux and the isotopic composition of river borne supply of metals to the ocean requires a clear understanding of their respective reactive transport pathways across estuaries. We will present our seasonally resolved concentration data of select metals from both fluid and suspended phases, collected at high spatial, temporal, and tidal resolution, from the Hooghly (Ganga) Estuary (S: 0.1– 24.45 psu). We utilized our novel method, characterized by matrix matching between calibration standards and estuarine samples, for simultaneous and direct determination of alkali, alkaline earth, transition, and heavy metal concentrations (Li to U) from estuarine samples.

The transport of metals across the Hooghly Estuary demonstrates a wide range of element specific behaviour. For example, we record a 10-220% release of dissolved [V], [Cu] and [Ba] in the middle estuary (S=0.2-10 psu). Whereas quasi-conservative behaviour for the same metals is observed in the upper estuary (S>10 psu). The concurrence of elemental concentration maxima with SPM load maxima (mg/L) indicates significant desorption of these metals from sediments to fluid phase with increase in ionic strength of the river. This sedimentary release results in significant addition (mol/ year) of these metals from middle estuary: $1.5-3.8 \times 10^6$ for V; $8.3-27 \times 10^6$ for Cu; and $4.1-21.7 \times 10^6$ for Ba. However, dissolved [Cr] behaves non-conservatively, characterized by an overall increasing trend (~1.48–4.11 nM) between S of 0.1–20.1 psu. A strong positive correlation of Cr with Fe in the suspended particulate phase indicates a possible association of Cr with Fe-oxyhydroxide phases. Whereas, dissolved [Co] in the non-monsoon period demonstrates quasi-conservative behaviour with concentration ranging between 0.16–0.58 nM. A strong inter-season variability in [Ba] and [U] is recorded. These observations underpin the significance of residence time of the dissolved and suspended phases and a possible shift in in-situ sources in the estuary. Li isotope data of dissolved and SPM will be utilised to tease apart the ion-exchange processes.